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(54) Abstract Title
Radio communication system capable of determining a provider access point

(57) When a radio communication apparatus 1 is required to register its location, the apparatus sends a registration request signal to a base station 10. In response, the base station sends a location information signal to the apparatus. The apparatus separates toll number information particular to the base station from the location information signal. The apparatus compares the toll number information and a plurality of phone numbers each being assigned to a particular provider access point and stored in a memory beforehand, thereby selecting one phone number identical with the toll number information. The apparatus stores the phone number selected in a memory. When the user of the apparatus operates the apparatus for starting data communication, the apparatus originates a call with the phone number stored in the memory.

Fig.1

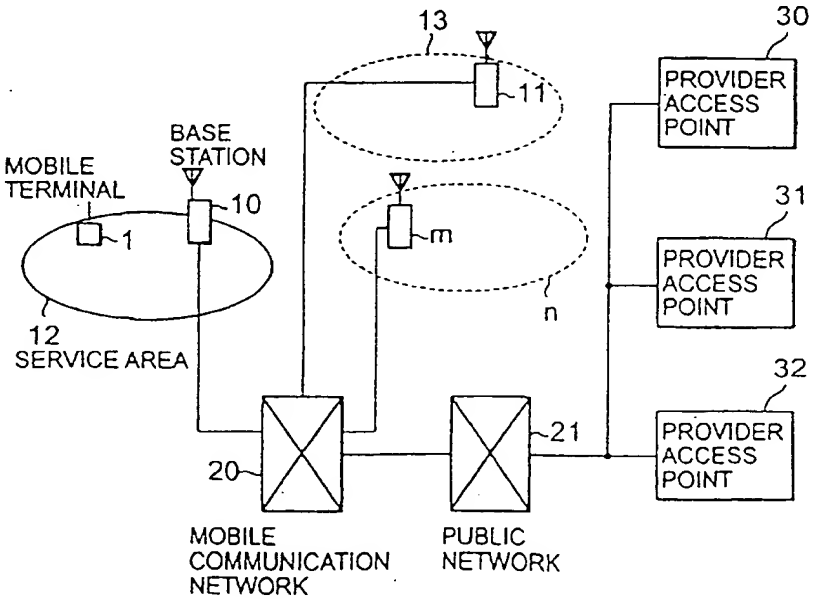

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Fig.1

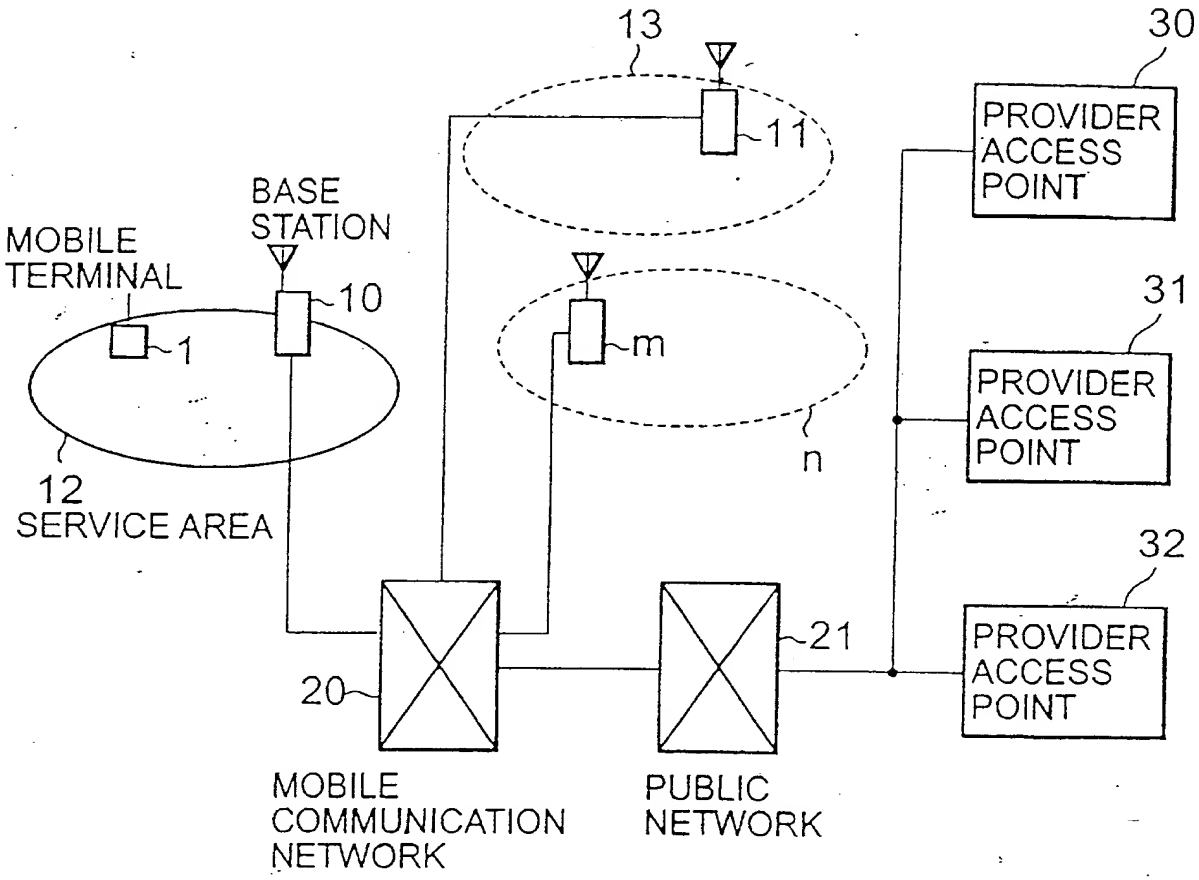


Fig.2

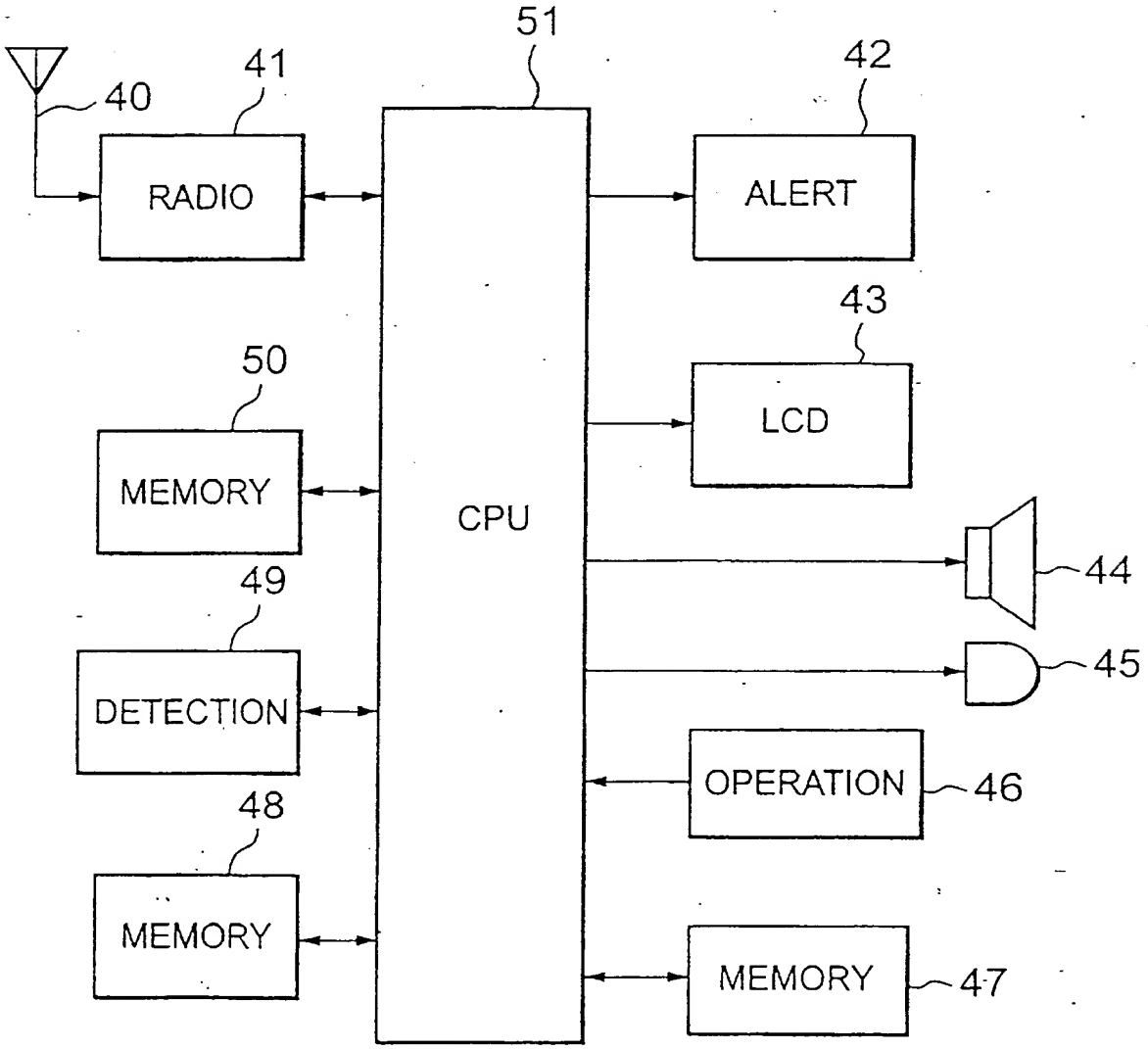


Fig.3

ADDRESS	ACCESS POINT NAME	ACCESS POINT PHONE NUMBER
1	ACCESS POINT 1	03-1111-1111
2	ACCESS POINT 2	045-222-2222
3	ACCESS POINT 3	044-333-3333
4	ACCESS POINT 4	052-444-4444
5	ACCESS POINT 5	06-555-5555
6	ACCESS POINT 6	092-666-6666

Fig.4

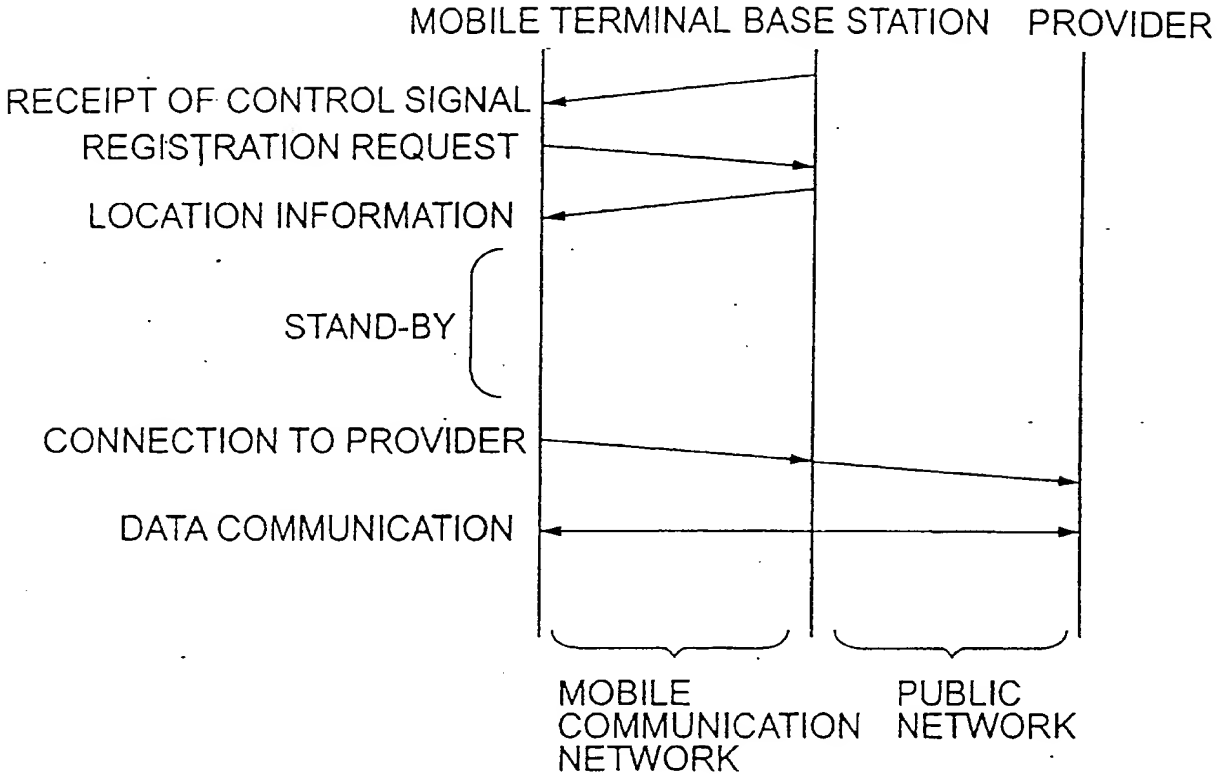


Fig.5

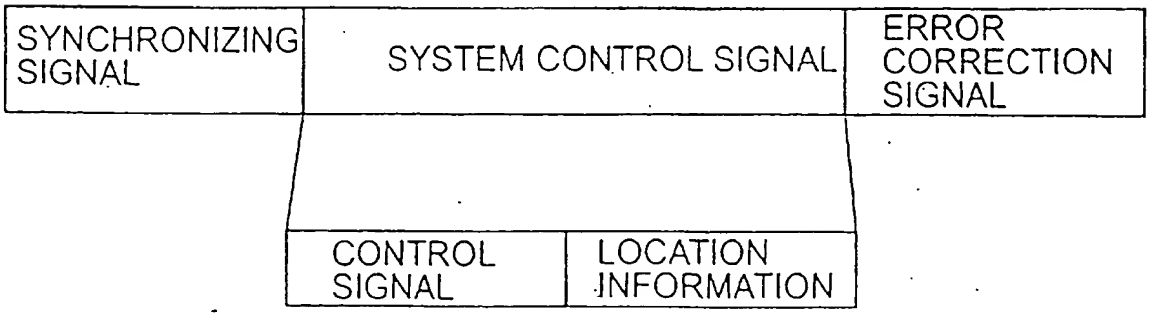


Fig.6

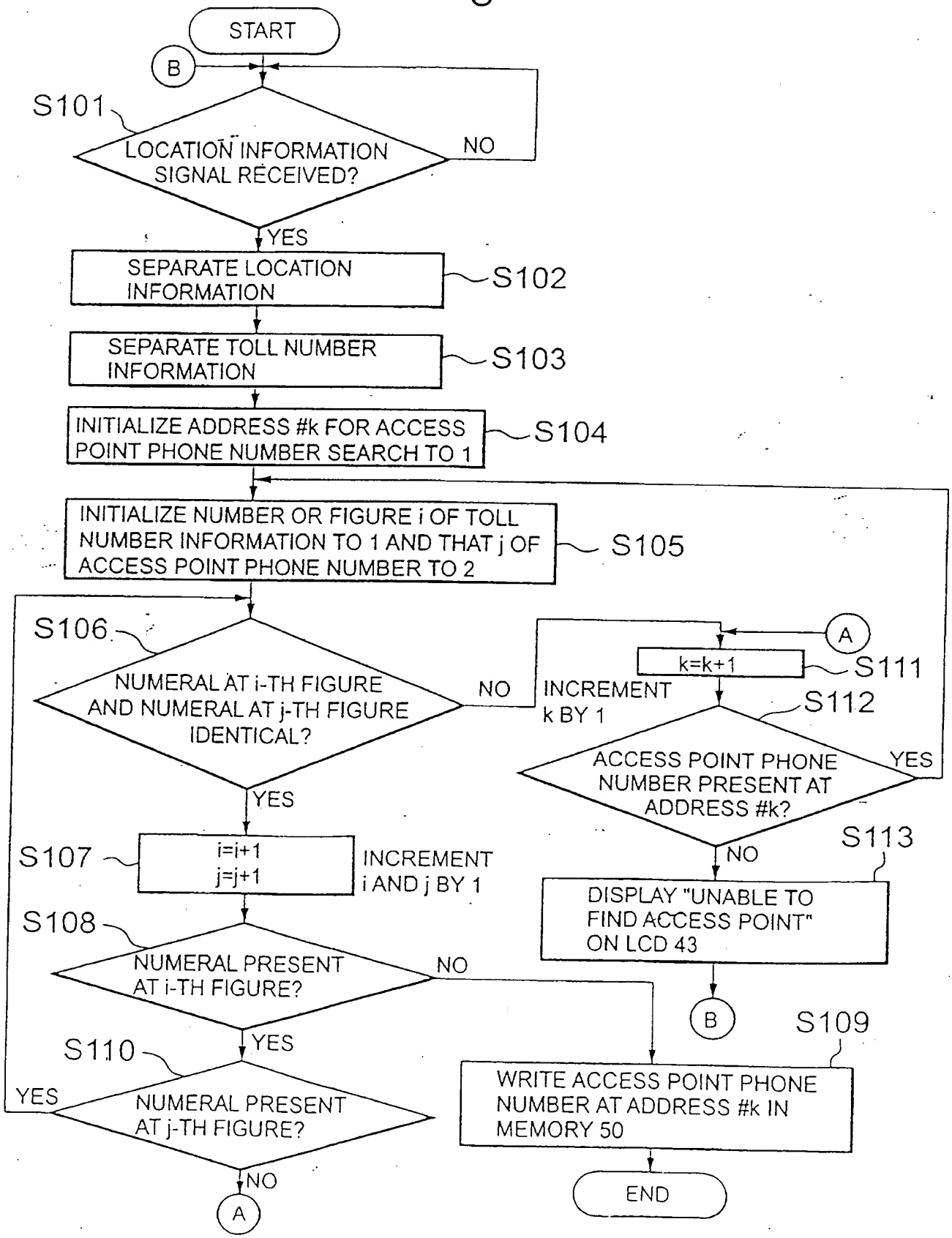


Fig.7

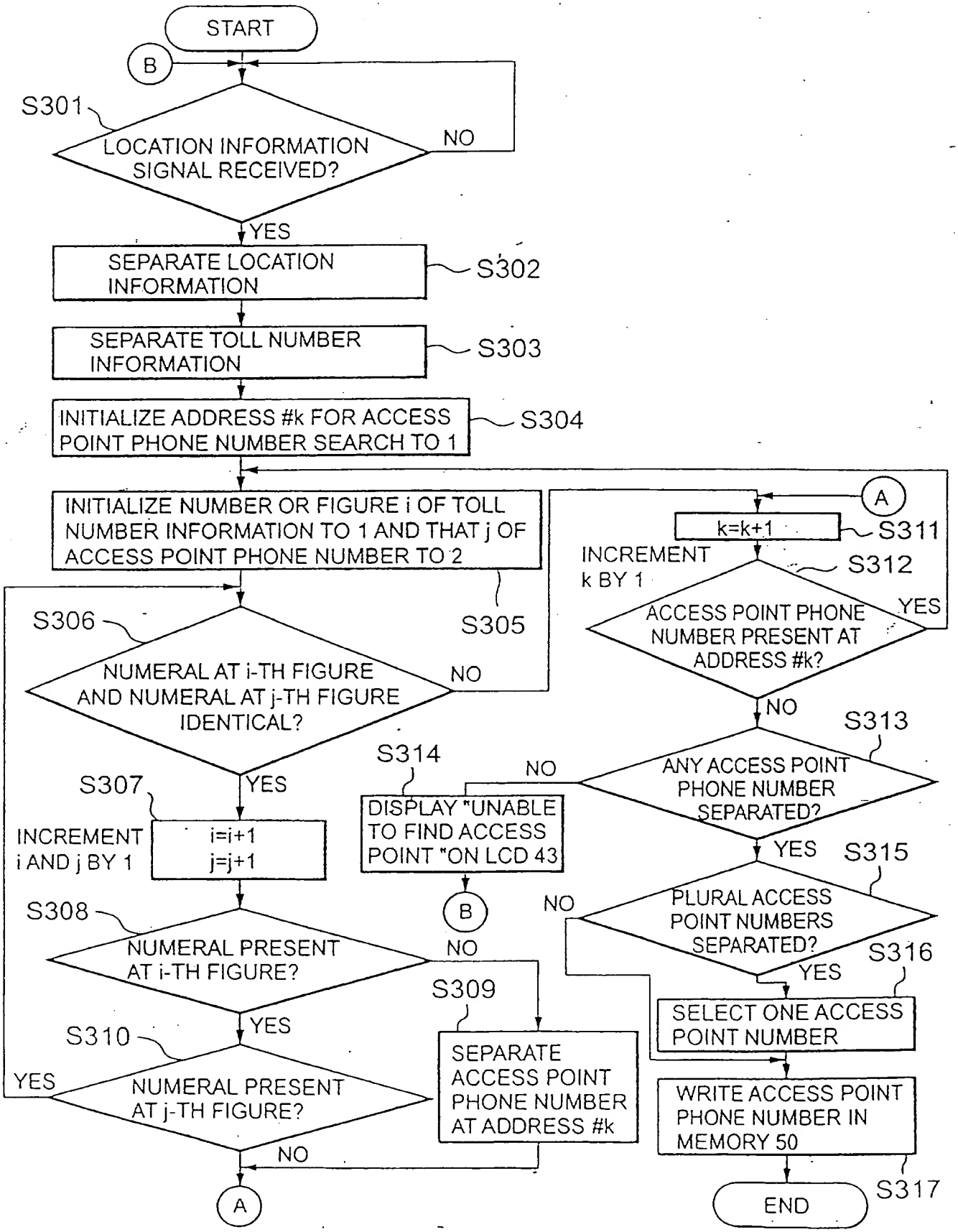

START
B
S301
LOCATION INFORMATION SIGNAL RECEIVED?
NO
YES
SEPARATE LOCATION INFORMATION
S302
SEPARATE TOLL NUMBER INFORMATION
S303
INITIALIZE ADDRESS #k FOR ACCESS POINT PHONE NUMBER SEARCH TO 1
S304
INITIALIZE NUMBER OR FIGURE i OF TOLL NUMBER INFORMATION TO 1 AND THAT j OF ACCESS POINT PHONE NUMBER TO 2
S305
S306
NUMERAL AT i-TH FIGURE AND NUMERAL AT j-TH FIGURE IDENTICAL?
NO
YES
S307
INCREMENT i AND j BY 1
i=i+1
j=j+1
S308
NUMERAL PRESENT AT i-TH FIGURE?
NO
YES
S310
NUMERAL PRESENT AT j-TH FIGURE?
YES
NO
A
A
k=k+1
S311
INCREMENT k BY 1
S312
ACCESS POINT PHONE NUMBER PRESENT AT ADDRESS #k?
YES
NO
S313
ANY ACCESS POINT PHONE NUMBER SEPARATED?
NO
S314
DISPLAY "UNABLE TO FIND ACCESS POINT "ON LCD 43
B
YES
S315
PLURAL ACCESS POINT NUMBERS SEPARATED?
NO
YES
S316
SELECT ONE ACCESS POINT NUMBER
S309
SEPARATE ACCESS POINT PHONE NUMBER AT ADDRESS #k
WRITE ACCESS POINT PHONE NUMBER IN MEMORY 50
END
S317

Fig.8

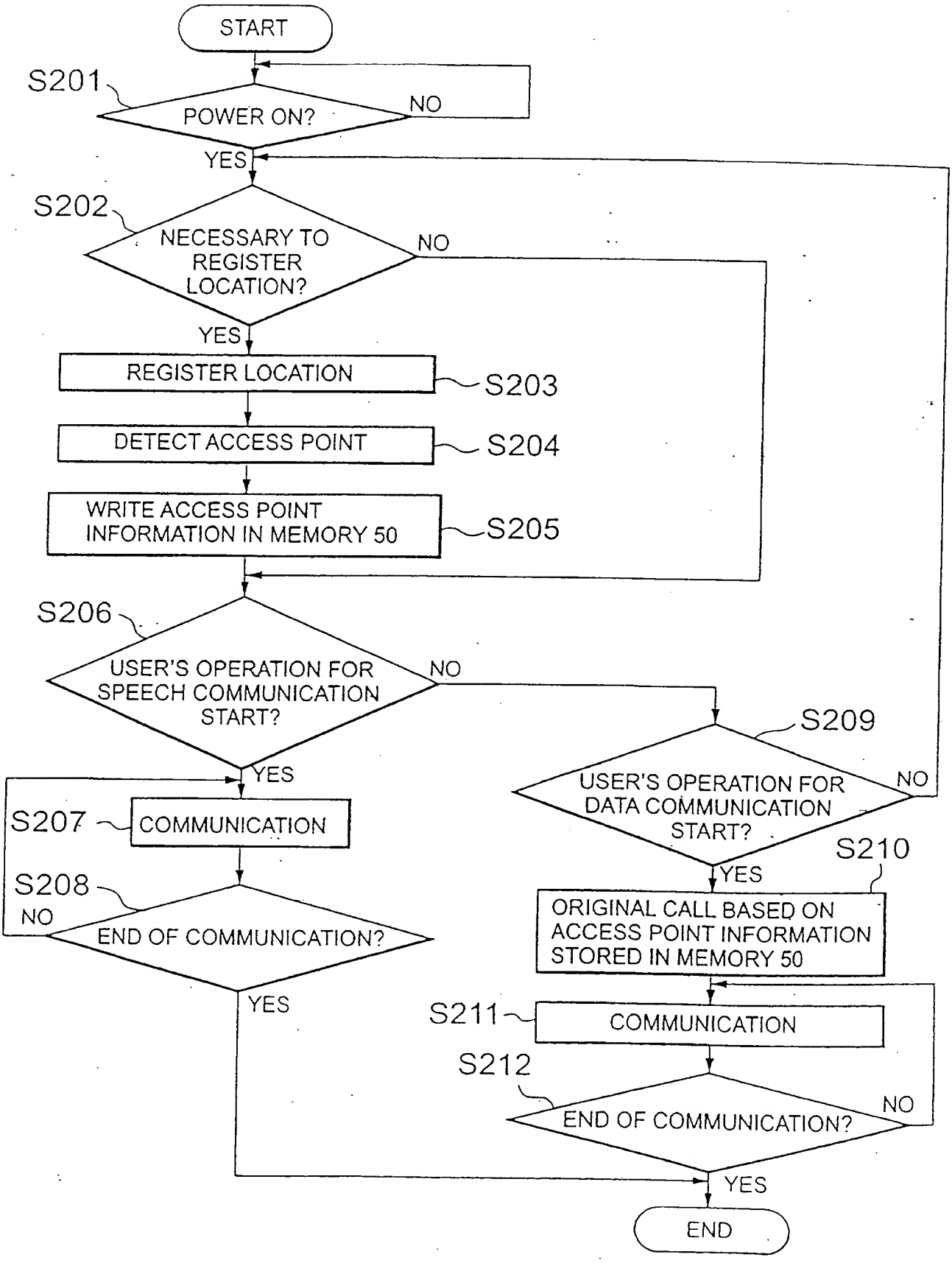


Fig.9

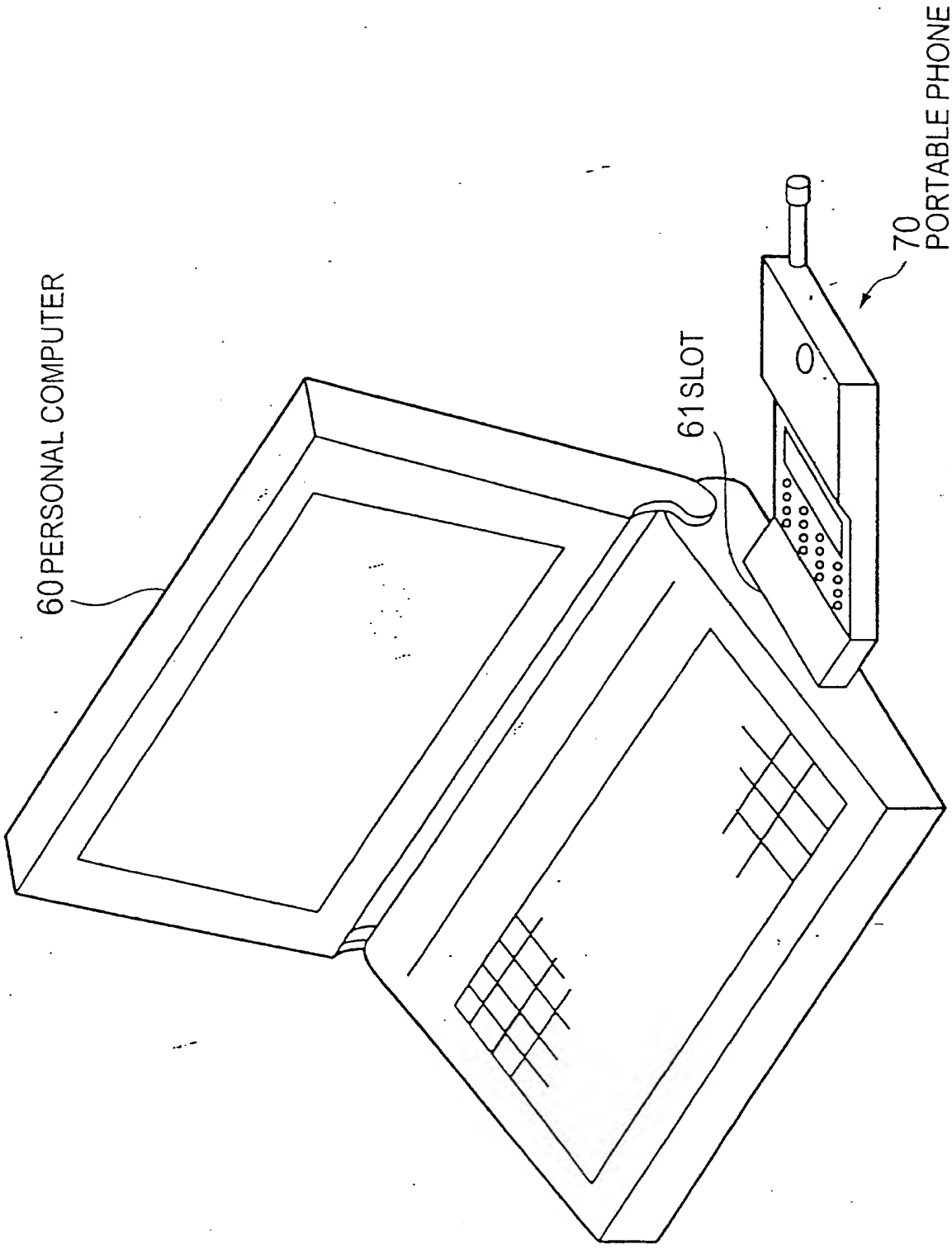


Fig.10

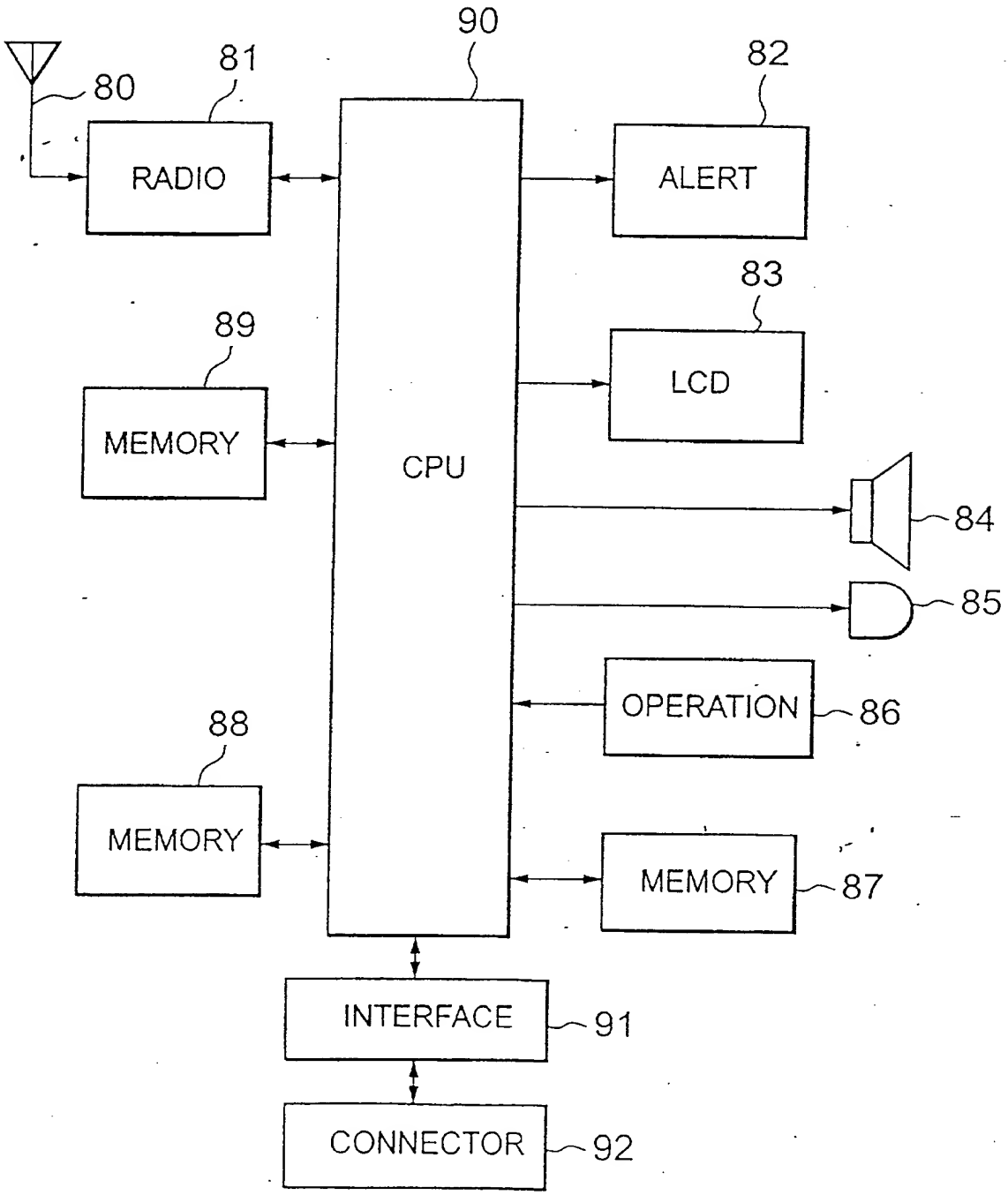


Fig.11

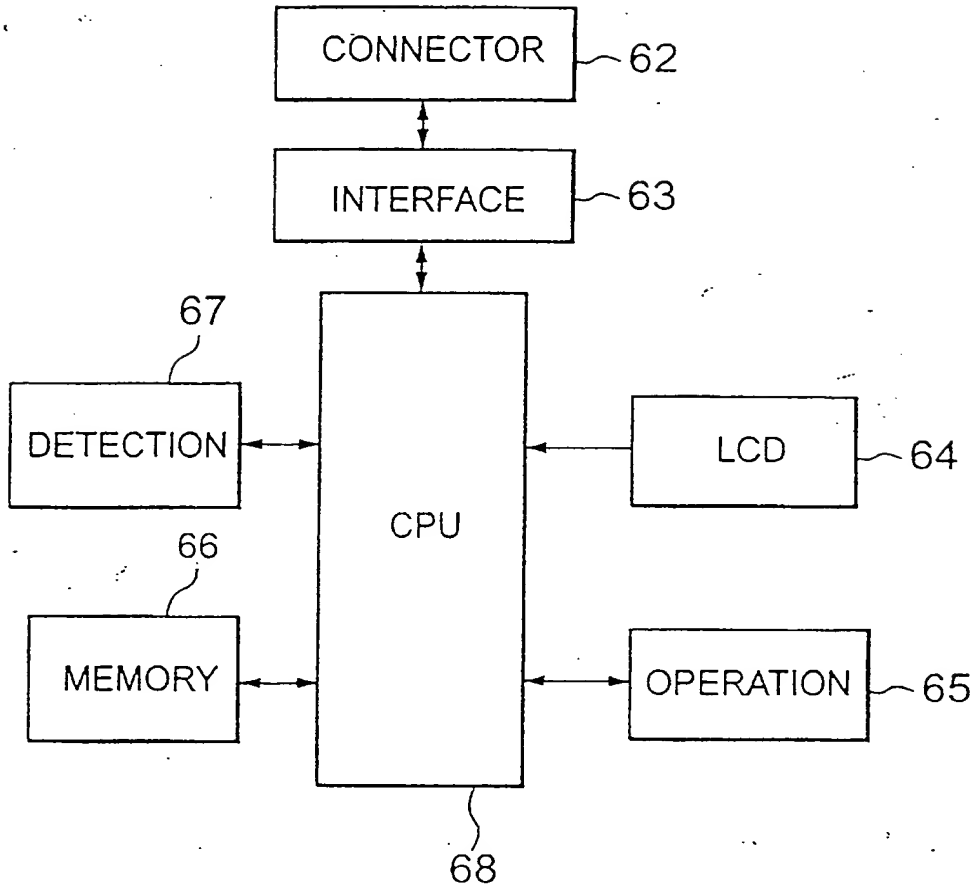


Fig.12

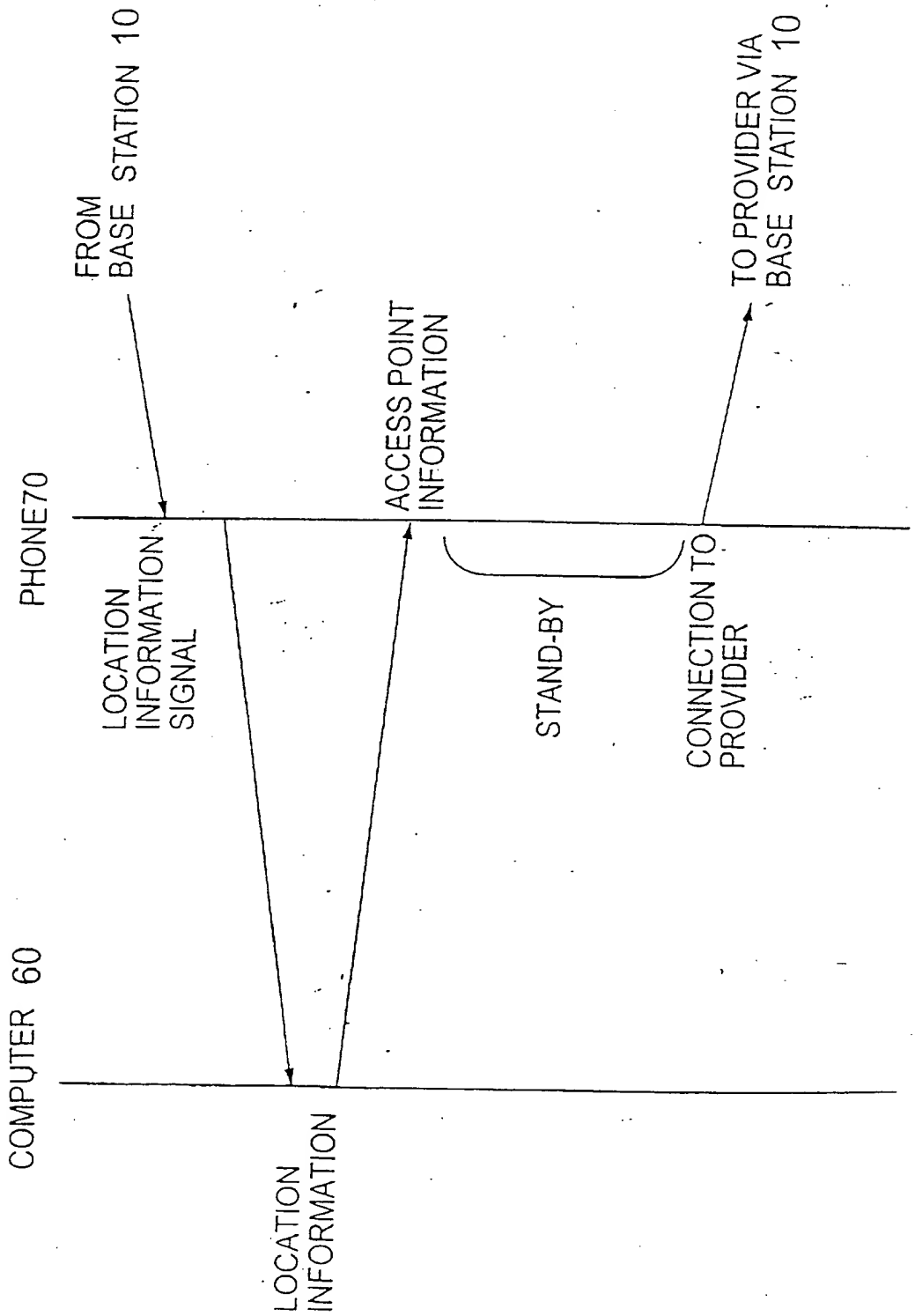


Fig.13

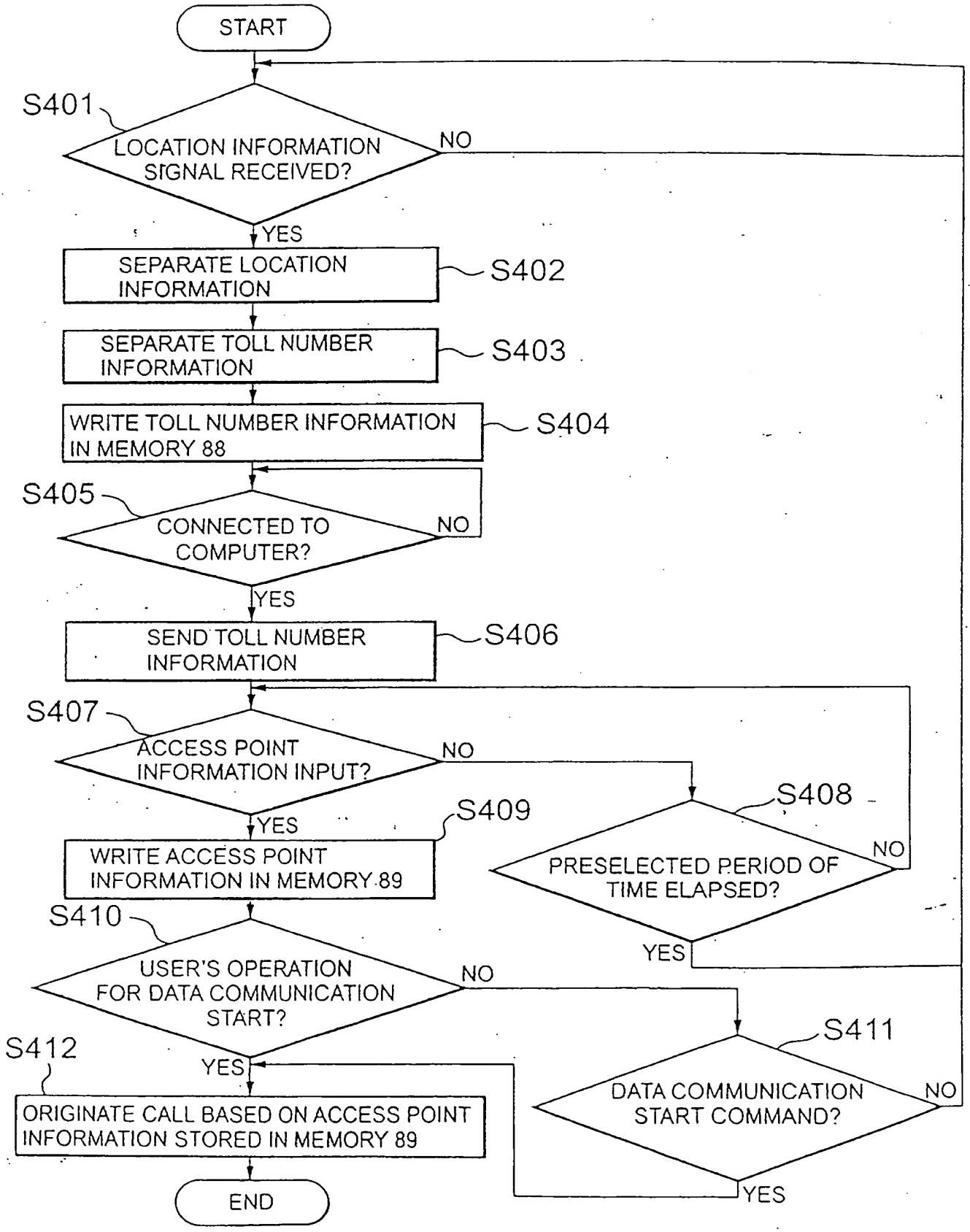
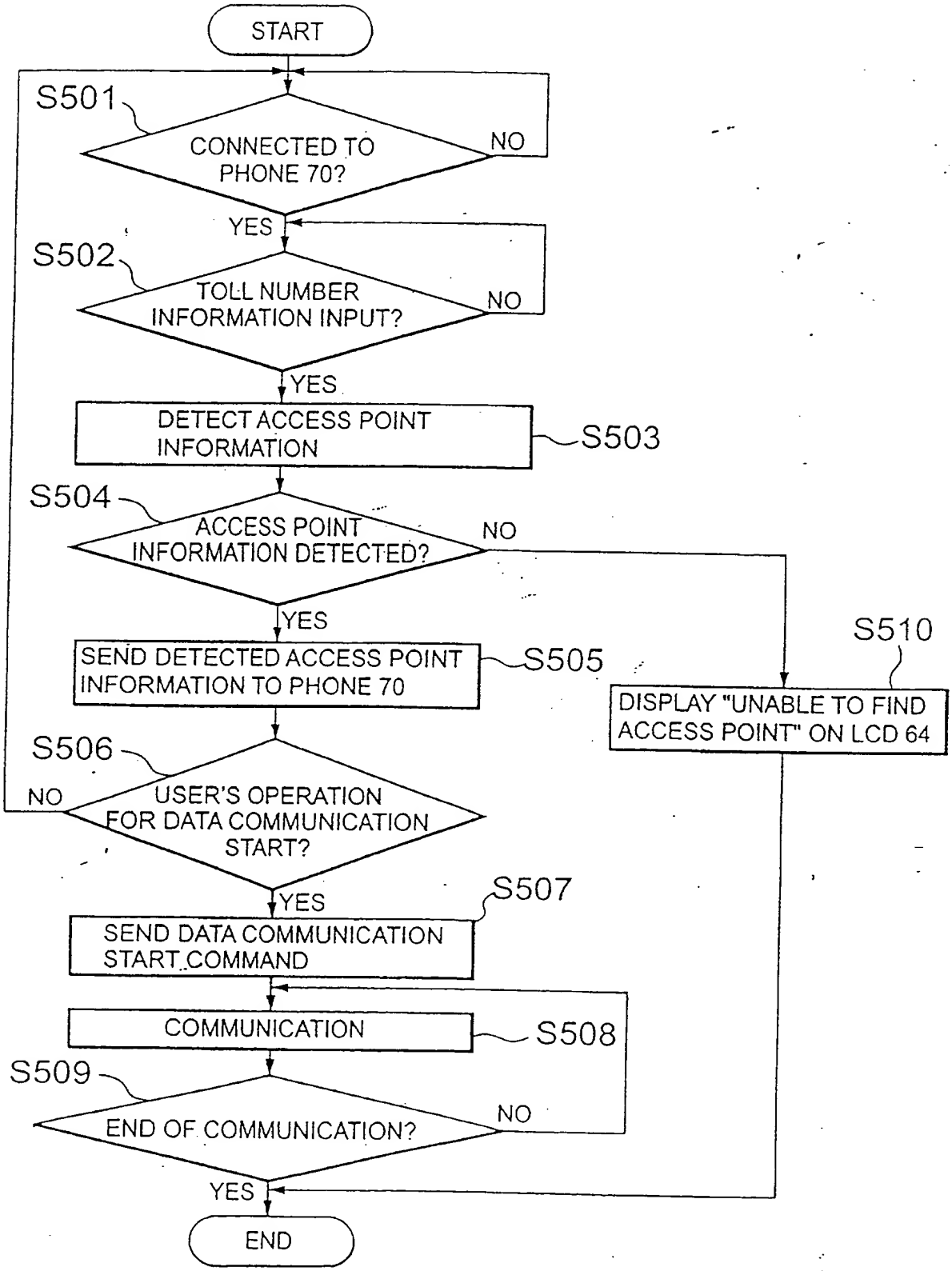


Fig.14



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RADIO COMMUNICATION APPARATUS CAPABLE OF DETERMINING A PROVIDER ACCESS POINT

BACKGROUND OF THE INVENTION

Field of the Invention

The present invention relates to a radio communication apparatus and more particularly to a radio communication apparatus having a data communication capability.

Description of the Related Art

A dealer-locator service is conventional with fixed phones and connects a caller to one of a plurality of dealers or service stations geographically closest to the caller. Specifically, the dealer-locator service geographically locates a caller by using the caller's phone number and locates, based on the location of the caller, a dealer physically closest to the caller.

The above dealer-locator service physically locating a caller by using the caller's phone number is applicable to fixed phones. However, this kind of service is not applicable to portable radio apparatuses including portable phones and mobile data terminals. This is because portable radio apparatuses do not stand still, i.e., phone numbers assigned to portable apparatuses do not indicate physical locations of the apparatuses.

In light of the above, European patent publication No. 800320 laid open to public inspection on October 8, 1997 (European patent application No. 97302011) discloses a dealer-locator service for portable phones. The dealer-locator service taught

in this document selects a dealer to which a caller should be connected on the basis of the ID of a called base station in place of the caller's phone number. Specifically, when a caller originates a call, a called base station sends its ID to a dealer-locator service unit via a switch. The dealer-locator service unit searches, based on the ID received from the base station, a data base stored therein and listing base stations and dealers closest thereto in one-to-one correspondence. After selecting a dealer corresponding to the above ID on the data base, the service unit connects the call to the phone number of the dealer selected.

Further, the above document describes that the physical location of a mobile station may be determined by using a method taught in, e.g., US patent 5,293,645 or 5,479,482.

However, the problem with the above conventional dealer-locator service is that the dealer-locator service unit must be connected to the switch and is therefore costly and lacks general-purpose applicability.

SUMMARY OF THE INVENTION

It is therefore an object of the preferred embodiment of the present invention to provide a radio communication apparatus constituting a further improvement over the above conventional radio communication apparatus.

It is another object of the preferred embodiment of the present invention to provide a radio communication apparatus capable of being connected to a provider access point geographically closest to the user of the apparatus at the time of data communication without resorting to

a dealer-locator service unit.

In accordance with the present invention, a radio communication apparatus includes a processing section for executing, when a preselected condition is satisfied, processing relating to location registration, a receiving section for receiving a location information signal at the time of location registration, a setting section for setting an optimal provider access point on the basis of the location information signal, a calling section for calling the provider access point set by the setting section, and a communicating section for holding data communication with the provider access point. Preferably, the apparatus additionally includes a storage for storing provider information relating to provider access points beforehand, a separating section for separating location information included in the location information signal, a comparing section for comparing the location information and provider information, and a selecting section for selecting an optimal provider access point on the basis of the result of comparison. The provider information may advantageously be phone numbers each being assigned to a particular provider access point. The user of the apparatus may be capable of varying said provider information. The location information may preferably be a toll number of a base station sent the location information signal. When the selecting section selects a plurality of provider access points, a selecting section may preferably select one of them on the basis of the history of use of each provider access point or a preselected priority order. When the selecting section selects no provider access point, a reporting section may report the occurrence that

no provider access point is detected. The apparatus may preferably be a mobile data terminal.

Also, in accordance with the present invention, a radio communication apparatus is made up of a portable phone and equipment connectable thereto for effecting data communication. The portable phone includes a processing section for executing, when a preselected condition is satisfied, processing relating to location registration, a receiving section for receiving a location information signal at the time of the location registration, a separating section for separating location information included in the location information signal, a sending section for sending the location information to the equipment, an inputting section for receiving information relating to a provider access point from the equipment, and a calling section for originating a call on the basis of the information received via the inputting section. The equipment includes a storage for storing provider information relating to provider access points beforehand, an inputting section for receiving the location information from the portable phone, a comparing section for comparing the provider information and location information, a selecting section for selecting an optimal provider access point on the basis of the result of comparison, and a sending section for sending the information relating to the provider access point selected to the portable phone. The provider information may be phone numbers each being assigned to a particular provider access point. The location information may be a toll number assigned to a base station sent the location information signal. Preferably, the equipment

further includes a reporting section for reporting, when the selecting section selects no provider access point, the occurrence that no provider access point is detected.

Further, in accordance with the present invention, a data communication control method for a radio communication apparatus includes the steps of registering a location when a preselected condition is satisfied, receiving a location information, setting an optimal provider access point on the basis of the location information signal, calling the provider access point set, and holding data communication with the provider access point. The method should preferably further include the steps of storing provider information relating to provider access points beforehand, separating location information included in the location information signal, comparing the location information and provider information, and selecting an optimal provider access point on the basis of the result of comparison.

Moreover, in accordance with the present invention, a data communication control method for a radio communication apparatus includes the step of connecting equipment to a portable phone. The portable phone includes the steps of registering a location when a preselected condition is satisfied, receiving a location information, separating location information included in the location information signal, and sending the location information to the equipment. The equipment includes the steps of storing provider information relating to provider access points beforehand, receiving the location information from the portable phone, comparing the provider information and location information, selecting an optimal provider access point on the

basis of the result of comparison, and sending the information relating to the provider access point to the portable phone. The portable phone should preferably further include the steps of receiving information relating to a provider access point from the equipment, and originating a call on the basis of the information received from the equipment. The portable phone may further include the step of determining, when the information relating to the provider access point is not received within a preselected period of time since sending of the location information to the equipment, that the equipment has failed to select an optimal provider access point. In addition, the equipment may further include the step of reporting, when no provider access point is selected, the occurrence that no provider access point is detected.

With the above configuration, the apparatus is capable of detecting by itself a provider access point geographically closer to the location of the apparatus than the others on the basis of a location information signal received from a base station. The apparatus can therefore be connected to a provider access point closer to the user of the apparatus for data communication without resorting to the conventional dealer-locator service unit.

BRIEF DESCRIPTION OF THE DRAWINGS

Preferred features of the present invention will now be described, by way of example only, with reference to the accompanying drawings, in which:-

Fig. 1 is a block diagram schematically showing a mobile communication system embodying the present invention;

Fig. 2 is a schematic block diagram showing a specific configuration of a mobile terminal included in the system of Fig. 1;

Fig. 3 shows a specific table stored in a memory included in the mobile terminal of Fig. 2;

Fig. 4 is a chart demonstrating a specific sequence to occur between the mobile terminal, a base station and a provider access point shown in Fig. 1;

Fig. 5 shows a specific format of a location information signal sent from the base station;

Fig. 6 is a flowchart showing a specific procedure for detecting a provider access point closer to the mobile terminal than the others;

Fig. 7 is a flowchart showing another specific procedure for detecting such a provider access point;

Fig. 8 is a flowchart showing a specific call origination procedure available with the mobile terminal of Fig. 2;

Fig. 9 is an external view showing an alternative embodiment of the present invention made in which a portable phone and a personal computer are connected to each other;

Fig. 10 is a schematic block diagram showing a specific configuration of the portable phone of Fig. 9;

Fig. 11 is a schematic block diagram showing a specific configuration of the personal computer of Fig. 9;

Fig. 12 is a chart showing a specific operation sequence to occur between the portable phone and the personal computer of Fig. 9;

Fig. 13 is a flowchart showing a specific operation of the

portable phone of Fig. 9 for obtaining access point information; and

Fig. 14 is a flowchart showing a specific operation of the personal computer of Fig. 9 for starting data communication.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

Referring to FIG. 1, a mobile communication system embodying the present invention is shown and includes a plurality of base stations 10, 11 and *m* connected to a mobile communication network 20. The base stations 10, 11 and *m* form particular service areas 12, 13 and *n*, respectively. Provider access points 30, 31 and 32 are connected to the base stations 11, 12 and *m* via a public network 21 and the mobile communication network 20. In accordance with the present invention, a radio communication apparatus, e.g., a mobile data terminal 1 lying in the service area 12 registers its location at the base station 10 and then executes data communication with the base station 10.

In accordance with the present invention, a mobile terminal includes not only a communication capability using a personal computer or a facsimile apparatus, but also a speech communication capability using, e.g., PHS (Personal Handyphone System) or a portable phone. This kind of mobile terminal may be implemented by Pinocchio (trade name) available from Matsushita Electric Industrial Co., Ltd. or GENIO (trade name) available from TOSHIBA CORP.

It is to be noted that the number of base stations, the number of service areas and the number of provider access points are not limited to three.

Fig. 2 shows a specific configuration of the mobile terminal 1. As shown, the mobile terminal 1 includes a radio 41 for receiving a radio signal sent from the base station 10 via an antenna 40. An alert 42 alerts the user of the terminal 1 to a call incoming and should preferably be implemented by at least one of a speaker, an LED (Light Emitting Diode) and a vibrator. An LCD (Liquid Crystal Display) 43 is capable of displaying information relating to a provider access point to be connected in addition to time, outside/inside with respect to a service area, call incoming, destination's phone number, etc. A receiver 44 outputs a speech received from the other party during conversation or outputs a tone generated by a controller. When the alert 42 is implemented by a speaker, the receiver 44 may play the role of the alert 42 at the same time. The user's speech is input to a transmitter 45. An operation 46 is operated by the user to set various functions available with the terminal 1, to turn on or turn off a power switch, not shown, to originate or answer a call, or to start data communication. A memory 47 stores the latest information relating to a service area at which the terminal 1 has registered its location. The base station sends a control signal to the terminal 1 at preselected intervals. A CPU (Central Processing Unit) 51 compares service area information included in the above control signal and representative of a service area in which the terminal 1 lies and the service area information stored in the memory 47. If the two pieces of service area information are not coincident, the CPU 51 sends a registration request to the base station.

A memory 48 stores information relating to the plurality

of provider access points. After the terminal 1 has sent a registration request to the base station, it receives a location information signal from the base station. A detection 49 compares location information included in the above location information signal and the provider access point information stored in the memory 48, thereby detecting a provider access point closer to the terminal 1. Information relating to the provider access point detected by the detection 49 is written to a memory 50. When the user manipulates the operation 46 in a preselected manner for starting data communication, the CPU 51 automatically connects the terminal 1 to the provider access point stored in the memory 50.

The above structural elements of the terminal 1 are powered by a battery section not shown. The memories 47, 48 and 50 may each be implemented by a particular area of a single memory. Generally, the memories 47, 48 and 50 are constituted by a RAM (Random Access Memory).

Fig. 3 shows a specific table stored in the memory 48 of Fig. 2. As shown, the memory or table 48 includes addresses #1-#6 where access point names representative of provider access points and access point phone numbers assigned to the provide access points are stored in one-to-one correspondence. The user may manipulate the operation 46 to add, change or delete the access point names and access point phone numbers stored in the memory 48, as desired. If desired, the memory 48 may additionally list any other information relating to the provider access points, e.g., the addresses of the provider access points. Of course, the six different provider access point information shown in Fig. 3 are

only illustrative and may be replaced with any other desired number of information.

Fig. 4 shows a specific operation sequence to occur between the mobile terminal 1, base station and provider access point included in the system of Fig. 1. As shown, after the turn-on of the power switch, the terminal 1 periodically receives the previously mentioned control signal from the base station 10 covering the terminal 1. In response, the terminal 1 determines whether or not the current service area and the service area previously stored in the memory 47 are coincident. If the two service areas are not coincident, the terminal 1 sends a registration request signal to the base station 10 (registration processing).

For example, assume that the terminal 1 having registered its location in the service area 13 is turned off, then moved to the service area 12, and then turned on. Then, at the time when the terminal 1 is turned on in the service area 12, information relating to the previous service area 13 is stored in the memory 47. In this case, the terminal 1 determines that the current service area 12 differs from the previous service area 13 on the basis of the control signal received from the base station 10, and executes the registration processing.

Also, assume that the terminal 1 having registered its location in the service area 12 in its ON state is moved to the service area 13 in the ON state. Then, information relating to the service area 12 is stored in the memory 47 until the terminal 1 enters the service area 13. As a result, the terminal 1 determines, based on the control signal received from the base

station 11 covering the service area 13, that the current service area 13 differs from the previously registered service area 12, and executes the registration processing.

If the terminal 1 determines, based on the above control signal, that it is required to register its location at the base station 10, it sends a registration request signal to the base station 10. In response, the base station 10 sends a location information signal including information relating to its location to the terminal 1.

Fig. 5 shows a specific format of the location information signal sent from the base station 10 to the terminal 1. As shown, the signal is made up of a synchronizing signal, a system control signal and an error correction signal. The system control signal is made up of a control signal and location information. The synchronizing signal is used to synchronize the terminal 1 to a radio communication channel and may have six bits by way of example. The control signal controls location information, i.e., indicates the presence of location information and may have four bits. The location information relates to the location of the base station 10 and may have twenty-four bits. The error correction signal is used for the detection and correction of errors and may have four bits.

The location information may consist of a base station number particular to each base station, e.g., "aaa" and a toll number covering the base station, e.g., "45". The resulting format is "aaa:45". While a toll number usually begins with "0" (e.g. "045" for Yokohama City), the heading "0" is omitted from the location information to be sent from the base station although

the whole toll number may, of course, be used.

Referring again to Fig. 4, on receiving the location information signal from the base station 10, the terminal 1 compares the location information included in the signal and the provider access point information stored in the memory 48. The terminal 1 detects, based on the result of comparison, a provider access point closer to the terminal 1 than the others, e.g., the provider access point 30. An access point phone number or similar information relating to the detected provider access point 30 is written to the memory 50. This information may be displayed on the LCD 43 either constantly or only when the user operates the operation 46.

Assume that the user operates the operation 46 for starting data communication while the terminal 1 is in a stand-by state. Then, the terminal 1 automatically originates a call with the phone number of the provider access point 30 stored in the memory 50. In response, the base station 10 connects the terminal 1 to the provider access point 30. Thereafter, the terminal 1 and provider access point hold data communication via the mobile communication network 20 and public network 21.

A specific procedure for the terminal 1 to detect a provider access point closer thereto than the others will be described with reference to Fig. 6. As shown, the terminal 1 first determines whether or not it has received a location information signal from a base station (step S101). If the answer of the step S101 is positive (YES), the terminal 1 separates location information from the location information signal (step S102). In addition, the terminal 1 separates toll number information, e.g., "45" from

the location information (step S103). To separate a toll number information, the terminal 1 may detect a symbol ":" and then the following information. On separating the toll number information, the terminal 1 initializes the search address #k for the access point phone number to be stored in the memory 48 (see Fig. 3) to "1" (step S104). At the same time, the terminal 1 initializes the number of a figure *i* for searching toll number information to "1" and initializes the number of a figure *j* for searching an access point phone number to "2" (step S105).

After the step S105, the terminal 1 determines whether or not a numeral at the i-th figure of the toll number information and a numeral at the j-th figure of the access point phone number stored at the address #k are identical (step S106). Specifically, the terminal 1 determines whether or not "4" at the first figure of the toll number information is identical with "3" at the second figure of the access point phone number "03-1111-1111" stored at the address #1. If the answer of the step S106 is negative (NO), the terminal 1 increments the address #k of the access point phone number by 1 (k = 2) (step S111). Then, the terminal 1 determines whether or not an access point phone number is present at the address #k, i.e., the address #2 (step S112). If the answer of the step S112 is YES, the terminal repeats the steps S105 and S106. That is, the terminal 1 determines whether or not "4" at the first figure of the toll number information is identical with "4" at the second figure of the access point phone number stored at the address #2 (step S106).

Assume that the numeral at the *i*-th figure of the toll number information and the numeral at the j-th figure of the access point

phone number stored at the #k address are identical, as determined in the step S106. Then, the terminal 1 increments each of the numbers *i* and *j* by 1 (step S107). As a result, *i* and *j* become "2" and "3", respectively. Subsequently, the terminal 1 determines whether or not a numeral is present at the i-th figure of the toll number information (step S108). If the answer of the step S108 is YES, the terminal 1 determines whether or not a numeral is present at the j-th figure of the access point phone number, i.e., at the second figure of the same (step S110). If the answer of the step S110 is YES, the terminal 1 again repeats the step S106 and successive steps. That is, the terminal 1 determines whether or not "5" at the second figure of the toll number information is identical with "5" at the third figure of the access point phone number.

Because the answer of the above step 106 is YES, the terminal 1 increments the numbers *i* and *j* to "3" and "4", respectively. However, because no numeral is present at the third figure of the toll number information (NO, step S108), the terminal 1 writes the access point phone number at the address #k in the memory 50 (step S109). That is, the access phone number at the address #2 is written to the memory 50. At the same time, the access phone number may be displayed on the LCD 43.

If no numeral is present at the j-th figure of the access point phone number (NO, step S112), the terminal 1 executes steps following the step S111, i.e., determines whether or not the toll number information is coincident with an access point phone number existing at the next address.

If an access phone number is not present at the address #k

(NO, step S112), the terminal 1 determines that the received toll number information is not identical with any one of the access point phone numbers existing in the memory 48. In this case, the terminal 1 displays on the LCD 43 a message showing the user that an optimal access point is not found at the time of registration, e.g., "Unable to find an access point". Alternatively, such an occurrence may be reported to the user via the alert 42 in a unique manner capable of distinguishing it from a usual call incoming.

In the specific procedure shown in Fig. 6, as soon as one access point phone number is detected, it is written to the memory 50. However, it may occur that two or more of the access point phone numbers stored in the memory 48 share the same toll number. In such a case, the terminal 1 may read all the access point phone numbers having the toll number represented by the toll number information, and select one of them in accordance with the history of use of each provider access point or in accordance with a preselected priority order. Further, the terminal 1 may write even the access point phone numbers other than one selected in the memory 50, so that it can call another phone number when failed to connect itself to the phone number selected.

Fig. 7 shows another specific procedure for the terminal 1 to detect a provider access point closer thereto than the others. In Fig. 7, steps S301-S308 and steps S310-S312 are respectively identical with the steps S101-108 and steps S110-S112 and will not be described specifically in order to avoid redundancy. In the procedure shown in Fig. 7, if a numeral is absent at the i-th figure of the toll number information (NO, step S312), the terminal 1 determines whether or not any phone number has already

been detected (step S313). If the answer of the step S313 is NO, the terminal 1 determines that none of the access point phone numbers stored in the memory 48 is identical with the toll number information. Therefore, the terminal 1 displays on the LCD 43 a message showing the user that an optimal access point is absent (step S314). The step S314 is identical with the step S113 of Fig. 6 and will not be described specifically in order to avoid redundancy.

On the other hand, if any phone number has already been detected (YES, step S313), the terminal 1 determines whether or not two or more phone numbers have been detected (step S315). If the answer of the step S315 is YES, the terminal 1 selects one of them in accordance with the history of use of each phone number or in accordance with a preselected priority order (step S316) and writes the phone number selected in the memory 50 (step S317). If the answer of the step S315 is NO, the terminal 1 writes one phone number selected in the memory 50 (step S317).

Fig. 8 shows a specific call origination procedure available with the terminal 1. As shown, when the user turns on the power switch of the terminal 1 (step S201), the terminal 1 determines whether or not the registration procedure is necessary (step S202). Specifically, the terminal 1 determines, based on the periodic control signal received from the base station 10, whether or not the current service area in which it lies and the previously registered service area, e.g., the service area information stored in the memory 47 are identical. If the answer of the step S202 is YES, the terminal 1 executes the registration processing, i.e., sends a registration request signal to the base

station 10 and then receives a location information signal from the station 10 (step S203). In response to the location information signal, the terminal 1 detects an access point phone number in accordance with the procedure of Fig. 6 or 7 (step S204) and writes it in the memory 50 (step S205).

After the step S205 or if the answer of the step S202 is NO, the terminal 1 determines whether or not the user has the operation 46 for starting speech communication (step S206). For this purpose, the terminal 1 may determine whether or not the user has pressed a call button for call origination or has pressed an answer button in response to an alert output from the alert 42. If the answer of the step S206 is YES, conversation is held on the terminal 1 (step S207) and then ended (step S208). In the step S208, the terminal 1 may determine whether or not the user has pressed an end button.

Assume that the user does not operate the operation 46 for the start of speech communication (NO, step S206). Then, the terminal 1 determines whether or not the user has operated the operation 46 for the start of data communication (step S209). For this decision, the terminal 1 may determine whether or not the user has operated the operation 46 in a preselected way. If the answer of the step S209 is NO, the terminal repeats the step S202 and successive steps until its power switch has been turned off.

If the answer of the step S209 is YES, the terminal 1 calls the provider access point represented by the phone number stored in the memory 50 (step S210). As a result, the terminal 1 is connected to the provider access point via the base station. Subsequently, data communication is held on the terminal 1 (step

S211) and then ended (step S212). In the step S212, the terminal 1 may determine whether or not the user has operated the operation 46 in a preselected way.

In the illustrative embodiment, it may occur that when the terminal 1 is moved from one service area to another service area adjoining it and registers its location at the new service area, location information included in a location information signal is identical with the last location information stored. More specifically, the base station covering the previous service area and the base station covering the new service area may share the same toll number information. In such a case, the access point detection described with reference to Fig. 6 or 7 would be repeated, consuming extra power.

To solve the above problem, it is preferable to write the detected access point phone number in the memory 50 together with toll number information. In this case, on receiving a location information signal from a base station, the terminal 1 compares toll number information included in the location information signal and the toll number information stored in the memory 50. If the two toll number information are identical, the terminal 1 does not execute the access point detection of Fig. 6 or 7 or update the access point phone number stored in the memory 50. Of course, if the above information are different from each other, the terminal 1 should execute the access point detection of Fig. 6 or 7.

While the illustrative embodiment has concentrated on a mobile terminal having a data communication function, the present invention is similarly practicable when a portable phone or PHS,

for example, is connected to a personal computer or similar apparatus for effecting data communication, as will be described hereinafter.

Fig. 9 shows an alternative embodiment of the present invention in which a portable phone 70 is connected to a personal computer 60. As shown, when the portable phone 70 is inserted into a slot 61 formed in the personal computer 60, a connector, not shown, arranged in the lower end of the phone 70 and a connector arranged in the slot 61 are connected together. In this condition, the phone 70 and computer 60 can interchange data with each other. While the phone 70 is shown as being directly connected to the computer 60, the former may, of course, be indirectly connected to the latter via exclusive connectors and an adapter.

Fig. 10 shows a specific configuration of the portable phone 70. Structural elements 80-87 and 89 shown in Fig. 10 are respectively identical with the structural elements 40-47 and 50 of Fig. 2 and will not be described specifically in order to avoid redundancy. As shown, the phone 70 includes a memory 88 for storing location information included in a location information signal received from a base station. A connector 92 is arranged in the bottom of the phone 70 and connectable to a connector arranged in the personal computer 60. An interface 91 interfaces the phone 70 to the computer 60 in accordance with control conditions prescribed by, e.g., PCMCIA. A CPU 90 has the following functions. When the connector 92 is connected to the connector included in the computer 60, the CPU 90 detects the connection via the interface 91 and sends location information stored in the memory 88 to the computer 60 via the interface 91

and connector 92. The CPU 90 writes an access point phone number input on the computer 60 in a memory 89. Further, when a data communication command is input on an operation 86, the CPU 90 originates a call with the access point phone number stored in the memory 89.

The above structural elements of the phone 70 are powered by a battery section not shown. The memories 87-89 may each be implemented by a particular area of a single memory. Generally, the memories 87-89 are constituted by a RAM (Random Access Memory).

Fig. 11 shows a specific configuration of the personal computer 60. While structural elements other than those shown in Fig. 11, of course, exist in the computer 60, they are not relevant to the understanding of the present invention and will not be described specifically. As shown, the computer 60 includes a connector 62 arranged in the slot 61 and connectable to the connector 92 of the phone 70. An interface 63, like the interface 91 of the phone 70, interfaces the computer 60 to the phone 70 under the conditions prescribed by PCMCIA. An LCD 64 displays a schedule, data received and to be transmitted, phone directory or the like, as needed. An operation 65 is usually implemented by a keyboard and operated by the user to prepare a schedule, data to send, phone directory or the like or to set various functions.

A memory 66, like the memory 48 of Fig. 2, stores information relating to a plurality of provider access points in the format shown in Fig. 3. A detection 67 compares location information input from the phone 70 via the connector 62 and interface 63 and the provider access point information stored in the memory 66 and

thereby selects one provider access point closer to the phone 70 than the others. The CPU 68 sends provider access point information representative of the provider access point selected by the detection 67 to the phone 70 via the interface 63 and connector 62.

The above structural elements of the computer 60 are powered by a battery section, not shown. The memory 66 is usually implemented by a RAM.

Fig. 12 demonstrates a specific operation sequence to occur between the portable phone 70 and the personal computer 60. A sequence to occur between the phone 70, the base station and the provider is identical with the sequence of Fig. 4 except for the substitution of the portable phone 70 for the mobile terminal 1 and will not be described specifically in order to avoid redundancy. As shown, when the phone 70 receives a location information signal from the base station 10, it separates toll number information from the received signal. If the phone 70 has already been connected to the computer 60 at the time of separation of the above toll number information, the phone 70 sends the toll number information to the computer 60; if otherwise, the phone 70 sends the same information to the computer 60 when the former is connected to the latter. The computer 60 sends, based on the toll number information received from the phone 70, information relating to a provider access point closer to the phone 70, e.g., an access point phone number to the phone 70. The phone 70 writes the access point phone number received from the computer 60 in the memory 89. Subsequently, the phone 70 originates a call with the access point phone number stored in the memory 89. This is

followed by data communication.

Fig. 13 shows a specific procedure for the portable phone 70 to obtain access point information. In Fig. 13, the phone 70 registers its location, if necessary, by executing the steps 201-203 described with reference to Fig. 8. The following description will concentrate on steps to follow the receipt of a location information signal from a base station. As shown, on the receipt of a location information signal from a base station (YES, step S401), the phone 70 separates location information form the received signal (step S402) and then separates toll number information from the location information (step S403). For the separation of the toll number information, the phone 70 executes the step S103 of Fig. 6. The separated toll number information is written to the memory 88 (step S404).

After the step S404, the phone 70 determines whether or not it is connected to the computer 60 (step S405). If the answer of the step S405 is YES, the phone 70 sends the toll number information stored in its memory 88 to the computer 60 via the interface 91 and connector 92 (step S406). Subsequently, the phone 70 determines whether or not it has received access point information from the computer 60 (step S407). If the answer of the step S407 is YES, the phone 70 writes the access point information in the memory 89 (step S409). Assume that the user operates the operation 86 for data communication in the stand-by state of the phone 70 (YES, step S410) or inputs it on the computer 60 (YES, step S411). Then, the phone 70 originates a call with the access point phone number stored in the memory 89 (step S412).

If the phone 70 does not receive access point information

from the computer 60 (NO, step S407), it determines whether or not a preselected period of time has elapsed (step S408). If the answer of the step S408 is YES, the phone 70 repeats the step S401 and successive steps. More specifically, when the computer 60 cannot detect access point information corresponding to the toll number information received from the phone 70, the phone 70 does not update the access point information existing in the memory 89. If desired, the phone 70 may display on the LCD 83 a message showing the user that an optimal access point is not found, e.g., "Unable to find an access point". Further, such an occurrence may be reported to the user via the alert 42 in place of the LCD 83.

Fig. 14 shows a specific operation of the personal computer 60 for starting data communication. As shown, the computer 60 determines whether or not it is connected to the phone 70 (step S501). If the answer of the step S501 is YES, the computer 60 determines whether or not it has received toll number information from the phone 70 (step S502). If the answer of the step S502 is YES, the computer 60 searches for access point information corresponding to the toll number information (step S503). The step S503 is based on the procedure described with reference to Fig. 6 or 7.

The computer 60 determines, based on the result of search, whether or not access point information corresponding to the toll number information is detected (step S504). If the answer of the step S504 is YES, the computer 60 sends the detected information or access point phone number to the phone 70 via the interface 63 and connector 62 (step S505). Subsequently, when the user

manipulates the operation 86 for starting data communication on the computer 60 (YES, step S506), the computer 60 sends a command indicative of the start of data communication to the phone 70 (step S507). In response, the phone 70 originates a call with the detected access point phone number. As a result, the computer 60 is connected to the called provider access point via a base station and holds data communication with the provider access point (step S508). When the data communication ends (YES, step S509), the specific procedure ends. To detect the end of data communication, the computer 60 may determine whether or not the user has manipulated the operation 65 in a preselected way.

When the computer 60 cannot detect optimal access point information (NO, step 504), it displays on its LCD 64 a message showing the user that an optimal access point is not found, e.g., "Unable to find an access point". At the same time, the computer 60 may send a signal representative of such an occurrence to the phone 70. This allows the phone 70 to recognize such an occurrence without executing the step 408 of Fig. 13, i.e., without waiting until a preselected period of time elapses.

While the above embodiment provides the personal computer 60 with the memories 66 and 67, the memories 66 and 67 may be built in the phone 70, if desired. Such an alternative configuration allows the phone 70 to detect optimal access point information and therefore makes it needless to change or modify the circuitry of an existing personal computer.

In the embodiments shown and described, whether or not toll number information included in a location information signal from a base station is identical with any one of access point phone

numbers stored in the memory 48 or 66 is determined for detecting a provider access point geographically closer to the radio communication apparatus. However, the detection based on phone numbers is only illustrative. For example, the memory 48 or 66 may store base station numbers particular to base stations and the phone numbers of access points closest to the base stations in one-to-one correspondence. In such a case, the communication apparatus will search for an access point phone number corresponding to a base station number included in a location information signal received from a base station. Further, the base station numbers may be replaced with longitudes and latitudes where the base stations are located.

In summary, it will be seen that the present invention provides a radio communication apparatus capable of detecting by itself a provider access point geographically closer to the location of the apparatus than the others on the basis of a location information signal received from a base station. The apparatus can therefore be connected to a provider access point closer to the user of the apparatus for data communication without resorting to the conventional dealer-locator service unit.

Obviously, numerous additional modifications and variations of the present invention are possible in light of the above teachings. It is therefore to be understood that within the scope of the appended claims, the invention may be practiced otherwise than specifically described herein.

Each feature disclosed in this specification (which term includes the claims) and/or shown in the drawings may be incorporated in the invention independently of other disclosed and/or illustrated features.

The text of the abstract filed herewith is repeated here as part of the specification.

When a radio communication apparatus is required to register its location, the apparatus sends a registration request signal to a base station. In response, the base station sends a location information signal to the apparatus. The apparatus separates toll number information particular to the base station from the location information signal. The apparatus compares the toll number information and a plurality of phone numbers each being assigned to a particular provider access point and stored in a memory beforehand, thereby selecting one phone number identical with the toll number information. The apparatus stores the phone number selected in a memory. When the user of the apparatus operates the apparatus for starting data communication, the apparatus originates a call with the phone number stored in the memory.

What is claimed is:

1. A radio communication apparatus comprising:

a processing section for executing, when a preselected condition is satisfied, processing relating to location registration;

a receiving section for receiving a location information signal at the time of the location registration;

a setting section for setting an optimal provider access point on the basis of the location information signal;

a calling section for calling the provider access point set by said setting section; and

a communicating section for holding data communication with the provider access point.

2. An apparatus as claimed in claim 1, further comprising:

a storage for storing provider information relating to provider access points beforehand;

a separating section for separating location information included in the location information signal;

a comparing section for comparing the location information and the provider information; and

a selecting section for selecting an optimal provider access point on the basis of a result of comparison output from said comparing section.

3. An apparatus as claimed in claim 2, wherein said provider information comprise phone numbers each being assigned to a particular provider access point.

4. An apparatus as claimed in claim 2, wherein a user of said apparatus is capable of varying the provider information.

5. An apparatus as claimed in claim 2, wherein the location information comprises a toll number of a base station sent the location information signal.

6. An apparatus as claimed in claim 2, further comprising a detecting section for detecting, when said selecting section selects a plurality of provider access points, one of said plurality of provider access points on the basis of a history of use of each provider access point.

7. An apparatus as claimed in claim 2, further comprising a detecting section for detecting, when said selecting section selects a plurality of provider access points, one of said plurality of provider access points in accordance with a preselected priority order.

8. An apparatus as claimed in claim 2, further comprising a reporting section for reporting, when said selecting section selects no provider access point, an occurrence that no provider access point is detected.

9. An apparatus as claimed in claim 1, wherein said apparatus comprises a mobile data terminal.

10. A radio communication apparatus comprising:

processing means for executing, when a preselected condition is satisfied, processing relating to location registration;

receiving means for receiving a location information signal at the time of the location registration;

setting means for setting an optimal provider access point on the basis of the location information signal;

calling means for calling the provider access point set by

said setting means; and

communicating means for holding data communication with the provider access point.

11. A radio communication apparatus comprising:

a portable phone; and

equipment connectable to said portable phone for effecting data communication;

said portable phone comprising:

a processing section for executing, when a preselected condition is satisfied, processing relating to location registration;

a receiving section for receiving a location information signal at the time of the location registration;

a separating section for separating location information included in the location information signal;

a sending section for sending the location information to said equipment;

an inputting section for receiving information relating to a provider access point from said equipment; and

a calling section for originating a call on the basis of the information received via said inputting section;

said equipment comprising:

a storage for storing provider information relating to provider access points beforehand;

an inputting section for receiving the location information from said portable phone;

a comparing section for comparing the provider information and the location information;

a selecting section for selecting an optimal provider access point on the basis of a result of comparison output from said comparing section; and

a sending section for sending the information relating to the provider access point selected by said selecting section to said portable phone.

12. An apparatus as claimed in claim 11, wherein the provider information comprise phone numbers each being assigned to a particular provider access point.

13. An apparatus as claimed in claim 11, wherein the location information comprises a toll number assigned to a base station sent the location information signal.

14. An apparatus as claimed in claim 11, wherein said equipment further comprises a reporting section for reporting, when said selecting section selects no provider access point, an occurrence that no provider access point is detected.

15. A data communication control method for a radio communication apparatus, comprising the steps of:

registering a location when a preselected condition is satisfied;

receiving a location information signal;

setting an optimal provider access point on the basis of the location information signal;

calling the provider access point set; and

holding data communication with the provider access point.

16. A method as claimed in claim 15, further comprising the steps of:

storing provider information relating to provider access

points beforehand;

separating location information included in the location information signal;

comparing the location information and the provider information; and

selecting an optimal provider access point on the basis of a result of comparison output from said comparing section.

17. A data communication control method for a radio communication apparatus, comprising the step of:

connecting equipment to a portable phone;

said portable phone comprising the steps of:

registering a location when a preselected condition is satisfied;

receiving a location information signal;

separating location information included in the location information signal; and

sending the location information to said equipment;

said equipment comprising the steps of:

storing provider information relating to provider access points beforehand;

receiving the location information from said portable phone;

comparing the provider information and the location information;

selecting an optimal provider access point on the basis of a result of comparison output; and

sending the information relating to the provider access point to said portable phone.

18. A method as claimed in claim 17, wherein said portable phone further comprising the steps of:

receiving information relating to a provider access point from said equipment; and

originating a call on the basis of the information received from said equipment.

19. A method as claimed in claim 18, wherein said portable phone further comprising the step of determining, when the information relating to the provider access point is not received within a preselected period of time since sending of the location information to said equipment, that said equipment has failed to select an optimal provider access point.

20. A method as claimed in claim 17, wherein said equipment further comprises the step of reporting, when no provider access point is selected, an occurrence that no provider access point is detected.

21. A radio communication apparatus substantially as herein described with reference to and as shown in any of the Figures 1 to 14 of the accompanying drawings.

22. A data communication control method substantially as herein described with reference to and as shown in any of the Figures 1 to 14 of the accompanying drawings.

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Claims searched: 1-22 **Date of search:** 22 February 2000

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Search Report under Section 17

Databases searched:

UK Patent Office collections, including GB, EP, WO & US patent specifications, in:

UK Cl (Ed.R): H4L(LDSM)

Int Cl (Ed.7): H04Q(7/22, 7/38)

Other: Online: WPI, PAJ, EPODOC

Documents considered to be relevant:

Category	Identity of document and relevant passage		Relevant to claims
X	EP 0800320 A2	(LUCENT TECHNOLOGIES) See Lines 15 to 30 of col.5, lines 55 of col.5 to line 1 of col.6, and lines 54 of col.6 to line 6 of col.7 especially.	1,10,11, 15, and 17, at least
A	US 5479482	(AT & T) See whole document.	

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Y	Document indicating lack of inventive step if combined with one or more other documents of same category.	P	Document published on or after the declared priority date but before the filing date of this invention.
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